

WE CLAIM:

1. A method for treating a subterranean formation intersected by a well casing that is perforated at a plurality of subsurface zones, comprising:

5 positioning within the well casing a service/completion liner assembly having a tool passage and having a plurality of interconnected packer / indicating extension tools isolating each of said plurality of subsurface zones and defining a plurality of isolated casing annulus zones within the well casing, each of said packer / indicating extension tools having at least one injection port and having a sliding sleeve valve assembly being moveable to open and closed positions relative to said at least one injection port, each of said packer / indicating extension tools having a downhole convertible
10 indicating collar defining an internal indicating profile and being selectively convertible to a “Go” condition preventing the landing of well treatment tools on said internal indicating profile thereof and a “No-go” condition exposing said internal indicating profile thereof for landing of a well service tool thereon;

15 running a well service tool into said tool passage of said service/completion liner assembly and into a selected packer indicating extension tool thereof and moving said sliding sleeve valve assembly to the open position thereof and actuating the selected downhole convertible indicating collar thereof to said “No-go” condition;

landing said well service tool on said internal indicating profile of the selected downhole convertible indicating collar, thus communicating said well service tool with a selected isolated

casing annulus zone via said at least one injection port of the selected packer / indicating extension tool; and

conducting well treatment by injecting well treatment fluid from said well service tool through said at least one injection port into the respective isolated casing annulus and through the casing perforations of the respective isolated casing annulus into the surrounding formation.

2. The method of claim 1, wherein an internal packoff device establishes sealing and wiping relation with said well service tool, said method comprising:

mounting said internal packoff device within said service/completion liner;

running said service/completion liner and said internal packoff device into the well casing simultaneously; and

establishing sealing engagement of said internal packoff device with said well service tool upon running of said well service tool into said service/completion liner.

3. The method of claim 1, wherein an internal packoff device establishes sealing and wiping relation with said well service tool, said method comprising:

mounting said internal packoff device within said service/completion liner;

assembling said well service tool within said service/completion liner and establishing sealing engagement of said internal packoff device with said well service tool;

running said service/completion liner, said internal packoff device and said well service tool into the well casing simultaneously.

4. The method of claim 1, wherein said step of running a well treatment tool into said tool passage of said service completion liner assembly and into a selected packer and indicating extension tool thereof comprising:

5 successively actuating said packer / indicating extension tools above the selected packer and indicating extension tool to said "Go" conditions thereof and moving said well treatment tool into the selected packer / indicating extension tool and converting the selected packer and indicating extension tool to said "No-go" condition; and

landing said well service tool on said internal indicating profile thereof.

5. The method of claim 1, comprising:

10 with the well service tool, converting selected "Go/No-go" indicating collars to the "Go" positions thereof and passing said well service tool therethrough;

with the well service tool converting a selected "Go/No-go" indicating collar of a selected isolated casing annulus zone to the "No-go" condition thereof exposing said internal indicating profile thereof for well service tool landing;

15 landing said well service tool on the exposed internal indicating profile of the selected "Go/No-go" indicating collar; and

conducting well treatment operations within the selected isolated casing annulus zone associated with the selected "Go/No-go" indicating collar.

6. The method of claim 1, wherein each of said downhole convertible indicating collars have a traveling sleeve therein defining a J-slot and having at lease one traveling sleeve movement control element within said J-slot and selectively controlling positioning of said traveling sleeve at an intermediate “No-go” position exposing said internal indicating profile for tool landing within said downhole convertible indicating collar and a lower “Go” position blocking said internal indicating profile and preventing tool landing within said downhole convertible indicating collar, said step of converting comprising:

establishing actuating connection of said well service tool with said traveling sleeve;

cycling said traveling sleeve upwardly and downwardly until said J-slot and control element establishes desired positioning of said traveling sleeve at said “No-go” position for tool landing or at said lower “Go” position for passage of said well service tool therethrough;

successively passing said well service tool through selected “Go/No-go” indicating collars to the isolated casing annulus zone of interest; and

with said traveling sleeve of a selected “Go/No-go” indicating collar at said “No-go” position thereof landing said well service tool on the internal indicating profile thereof to permit treatment of the isolated casing annulus zone of interest.

7. The method of claim 1 wherein each of said downhole convertible indicating collars have a traveling sleeve therein defining a J-slot and having at lease one sleeve movement control element within said J-slot and controlling positioning thereof at an intermediate “No-go” position exposing said internal indicating profile for tool landing within said downhole convertible indicating collar

and a lower “Go” position blocking said internal indicating profile and preventing tool landing within said downhole convertible indicating collar and wherein an actuating collet assembly is mounted on the well service tool and provides a landing and indicating collet members each having at least one indicating profile engaging element, said method comprising:

5 establishing releasable connection of said indicating profile engaging element with said internal traveling sleeve actuating profile;

 moving said service tool upwardly and downwardly and cycling said traveling sleeve element until said traveling sleeve is located at said intermediate “No-go” position by said position control element and said J-slot; and

10 moving said well treatment tool until said indicating profile engaging element establishes landing and indicating engagement with said internal indicating profile.

8. The method of claim 1, wherein said sliding sleeve valve assembly having a valve housing defining said injection ports and a sliding sleeve valve element being linearly moveable within said valve housing between open and closed positions and having an internal valve sleeve actuating profile, said step of moving said sliding sleeve valve assembly comprising:

15 engaging said internal sleeve actuating profile with said well service tool during downward movement thereof and moving said sliding sleeve element to said open position;

 continuing downward movement and landing of said well service tool; and

 when closure of said sliding sleeve element is desired, moving said well service tool
20 upwardly and establishing engagement thereof with said internal sleeve actuating profile and

continuing said upward movement of said well service tool and moving said sliding sleeve element to said closed position thereof.

9. Apparatus for treating a subterranean formation intersected by a well casing that is perforated at a plurality of subsurface zones, comprising:

5 a service/completion liner assembly having a plurality of interconnected packer / indicating extension tools isolating each of said plurality of subsurface zones and defining a plurality of isolated casing annulus zones within the well casing, said service/completion liner assembly defining a service tool passage;

10 said interconnected packer / indicating extension tools each having fluid injection ports and a sliding sleeve valve assembly being moveable to open and closed positions relative to said fluid injection ports, each of said packer / indicating extension tools having a downhole convertible indicating collar mechanism defining an internal indicating profile and having a "Go" condition preventing the landing of well service tools on said internal indicating profile and a "No-go" condition exposing said internal indicating profile for landing of well treatment tools thereon; and

15 a well service tool adapted for conveyance into and through said service tool passage and having an actuator collet adapted for selective converting actuation of said downhole convertible indicating collar assembly to said "Go" condition and said "No-go" condition.

10. The apparatus of claim 7, comprising:

an internal packoff device within said service/completion liner establishing sealing and wiping engagement with said well service tool when said well service tool is located within said service tool passage.

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11. The apparatus of claim 10, comprising:

said service/completion liner, said internal packoff device and said well service tool being assembled at the surface and simultaneously run into the well casing; and

a service tool conduit string being connected downhole with said well service tool.

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12. The apparatus of claim 9, comprising:

a latch member releasably latching said sliding sleeve valve assembly at said open and closed positions thereof and being releasable from latching condition upon application of predetermined linear force thereto by said well service tool.

13. The apparatus of claim 9, comprising:

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an actuating collet being mounted to said well service tool and selectively actuating said sliding sleeve valve assembly to said open and closed positions thereof.

14. The apparatus of claim 13, comprising:

a traveling sleeve being moveable within said indicating collar assembly to a “go” position preventing landing of said service tool on said internal indicating profile and a “no go” position exposing said internal indicating profile for service tool landing thereon; and

5 said actuating collet selectively establishing actuating engagement with said sliding sleeve valve assembly and said traveling sleeve for actuation movement thereof.

15. The apparatus of claim 9, comprising:

said sliding sleeve valve assembly having a tubular valve housing defining said injection ports and defining internal spaced latch recesses;

10 a sliding sleeve valve element being moveable within said tubular valve housing to an open position permitting fluid flow through said injection ports and a closed position blocking flow through said injection ports; and

a latch member being mounted to said sliding sleeve valve element and establishing releasable retaining engagement with respective latch recesses at said open and closed positions of
15 said sliding sleeve valve element, said latch member releasing from a respective latch recess upon application of predetermined valve releasing force thereto by said well service tool.

16. The apparatus of claim 9, wherein said downhole convertible indicating collar assembly comprising:

a tubular indicating collar defining an internal indicating profile;

a traveling sleeve being moveable within said tubular indicating collar to positions establishing said “Go” and “No-go” conditions; and

at least one sleeve control member projecting within said tubular indicating collar and having condition controlling engagement with said traveling sleeve.

5 17. The apparatus of claim 16, comprising:

at least one actuating profile being defined within said traveling sleeve and being releasably engaged for movement control by said well service tool, said well service tool being selectively cycled by said well service tool to cycle said traveling sleeve to said “Go” and “no-go” conditions thereof.

10 18. The apparatus of claim 16, comprising:

an annular internal receptacle being defined by said indicating collar; and

an annular traveling sleeve control element being located within said annular internal receptacle and supporting at least one control pin within said J-slot and controlling rotary and linear motion of said traveling sleeve to said “Go” and “no-go” conditions thereof.

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19. The apparatus of claim 9, comprising:

said well service tool being of sufficient length to extend substantially the length of said service completion liner assembly and having an upper packer element and an isolation wash pipe;

a well service mechanism being mounted to said isolation wash pipe and having an isolation seal assembly for selective sealing at desired locations within said service completion liner assembly,
5 said well treatment tool further having a set down indicating collar defining a tool indicating profile;

an annular internal receptacle being defined within said set down indicating collar;

a traveling sleeve control element being located within said annular internal receptacle and having at least one control projection thereon; and

said converting actuator being a traveling sleeve member having an external J-slot within
10 which said control projection is received and which controls rotational and linear positioning movement of said traveling sleeve member to a "Go" position permitting landing of said well service tool on said internal indicating profile and to a "No-go" position preventing landing of said well service tool on said internal indicating profile.

20. The apparatus of claim 9, comprising:

said traveling sleeve member defining an annular internal sleeve actuation profile; and

an actuating and landing collet assembly being supported by said well treatment tool and having a plurality of collet members each defining a slot profile for cycling engagement with said annular internal sleeve actuation profile and for landing engagement with said internal indicating
20 profile.

21. The apparatus of claim 20, wherein said actuating and landing collet assembly comprising:
a tubular collet support member being mounted to said well treatment tool;

said plurality of collet actuator members each being of elongate generally curved configuration and having spring-like characteristics and having a first end thereof disposed in substantially immovable relation with said tubular collet support member and a second end thereof being disposed in moveable relation with said tubular collet support member, said plurality of collet actuator members being radially expandable and collapsible responsive to engagement with internal surfaces of said packer / indicating extension tools during movement of said well service tool therein; and

collet members being provided intermediate said plurality of collet actuator members and having slot profiles for landing engagement with said internal indicating profiles.

22. Apparatus for treating a subterranean formation intersected by a well casing that is perforated at a plurality of subsurface zones, comprising:

a service/completion liner assembly having a plurality of interconnected packer and indicating extension tools for sealing within the well casing and isolating each of said plurality of subsurface zones and defining a plurality of isolated casing annulus zones within the well casing, said service/completion liner assembly defining a service tool passage;

said interconnected packer and extension tools each having a sleeve valve body defining fluid injection ports and a sliding sleeve valve being moveable within said sleeve valve body and defining

injection ports and being moveable to an open position with said injection ports in registry and a closed position with said injection ports blocked and preventing fluid flow;

each of said packer / indicating extension tools having a downhole convertible indicating collar mechanism defining an internal indicating profile;

5 a converting mechanism within each of said downhole convertible indicating collar mechanisms having a traveling sleeve member being moveable to positions establishing a "Go" condition preventing the landing of well treatment tools on said indicating profile and a "No-go" condition exposing said internal indicating profile for landing of well treatment tools thereon; and

10 a well service tool adapted for conveyance into and through said service tool passage and having an actuator collet adapted for selective movement of said sliding sleeve valve to said open and closed positions thereof and for converting actuation of said traveling sleeve member of said downhole convertible indicating collar assembly to said "Go" condition and said "No-go" condition.

23. The apparatus of claim 22, comprising:

15 a latch member releasably latching said sliding sleeve valve assembly at said open and closed positions thereof and being releasable from latching condition upon application of predetermined linear force thereto by said well service tool and

an actuating collet being mounted to said well service tool and selectively actuating said sliding sleeve valve assembly to said open and closed positions thereof.

24. The apparatus of claim 23, comprising:

a traveling sleeve being moveable within said indicating collar assembly to a “go” position preventing landing of said service tool on said internal indicating profile and a “no go” position exposing said internal indicating profile for service tool landing thereon; and

5 said actuating collet selectively establishing actuating engagement with said sliding sleeve valve assembly and said traveling sleeve for actuation movement thereof.

25. The apparatus of claim 22, comprising:

said sliding sleeve valve assembly having a tubular valve housing defining said injection ports and defining internal spaced latch recesses;

10 a sliding sleeve valve element being moveable within said tubular valve housing to an open position permitting fluid flow through said injection ports and a closed position blocking flow through said injection ports; and

15 a latch member being mounted to said sliding sleeve valve element and establishing releasable retaining engagement with respective latch recesses at said open and closed positions of said sliding sleeve valve element, said latch member releasing from a respective latch recess upon application of predetermined valve releasing force thereto by said well service tool.

26. The apparatus of claim 22, wherein said downhole convertible indicating collar assembly comprising:

a tubular indicating collar defining an internal indicating profile;

a traveling sleeve being moveable within said tubular indicating collar to positions
5 establishing said "Go" and "No-go" conditions; and

at least one sleeve control member projecting within said tubular indicating collar and having
condition controlling engagement with said traveling sleeve; and

at least one actuating profile being defined within said traveling sleeve and being releasably
engaged for movement control by said well service tool, said well service tool being selectively
10 cycled by said well service tool to cycle said traveling sleeve to said "Go" and "no-go" conditions
thereof.

27. The apparatus of claim 26, comprising:

an annular internal receptacle being defined by said indicating collar; and

an annular traveling sleeve control element being located within said annular internal
15 receptacle and supporting at least one control pin within said J-slot and controlling rotary and linear
motion of said traveling sleeve to said "Go" and "no-go" conditions thereof.

28. The apparatus of claim 22, comprising:

said well service tool being of sufficient length to extend substantially the length of said service completion liner assembly and having an upper packer element and an isolation wash pipe;

a well service mechanism being mounted to said isolation wash pipe and having an isolation seal assembly for selective sealing at desired locations within said service completion liner assembly,
5 said well treatment tool further having a set down indicating collar defining a tool indicating profile;

an annular internal receptacle being defined within said set down indicating collar;

a traveling sleeve control element being located within said annular internal receptacle and having at least one control projection thereon; and

said converting actuator being a traveling sleeve member having an external J-slot within
10 which said control projection is received and which controls rotational and linear positioning movement of said traveling sleeve member to a "Go" position permitting landing of said well service tool on said internal indicating profile and to a "No-go" position preventing landing of said well service tool on said internal indicating profile.

15 29. The apparatus of claim 22, comprising:

said traveling sleeve member defining an annular internal sleeve actuation profile; and

an actuating and landing collet assembly being supported by said well treatment tool and having a plurality of collet members each defining a slot profile for cycling engagement with said annular internal sleeve actuation profile and for landing engagement with said internal indicating
20 profile.

30. The apparatus of claim 29, wherein said actuating and landing collet assembly comprising:
a tubular collet support member being mounted to said well treatment tool;

said plurality of collet actuator members each being of elongate generally curved
configuration and having spring-like characteristics and having a first end thereof disposed in
5 substantially immovable relation with said tubular collet support member and a second end thereof
being disposed in moveable relation with said tubular collet support member, said plurality of collet
actuator members being radially expandable and collapsible responsive to engagement with internal
surfaces of said packer / indicating extension tools during movement of said well service tool
therein; and

10 collet members being provided intermediate said plurality of collet actuator members and
having slot profiles for landing engagement with said internal indicating profiles.